

UPDATE ON LONGLEAF PINE SEED SUPPLY MEETING

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This is an update of the activities following the September 1999 meeting concerning measures that were discussed to address the longleaf pine seed supply shortage. The people in attendance were Dr. Dean Gjerstad, Mark Haines, Robert Gandy, Larry Bishop, Dr. Ron Carey, Dr. Carey's graduate student Steve Oak, Dr. Jim Barnett, and Jill Barbour

An outline was developed and divided into short-term and long-term goals. Much progress has been made on the short-term goals and now it is time to address the long-term goals.

SHORT-TERM GOAL NUMBER 1: LONGLEAF PINE SEED PRODUCTION AREAS

The 1996 U. S. Forest Service publication, *The Longleaf Pine Forest: Trends and Current Conditions*, by Kenneth W. Outcalt and Raymond M. Sheffield SRS-9 Resource Bulletin, makes it possible to locate stands suitable for seed production. The report is based on information from the Forest Inventory and Analysis. Longleaf pine stands are identified by state, county, ownership, acreage, and timber size class. Trees in the sawtimber size class are most likely to be large and old enough to produce cones. The exact stand location can be pinpointed with the assistance of county foresters and county records. The publication needs to be reprinted because all the copies have been distributed.

A primer on the establishment and management of longleaf pine seed production areas has been written by Jill Barbour. It includes past research and current practical information needed to be successful at cone collection in the woods. It is now being reviewed and edited for content. The paper is targeted at the novice cone collectors, who want to begin collecting cones, and to the experienced collectors to further refine their technique.

SHORT-TERM GOAL 2 AND 3: SEED DRYERS AND CONE PROCESSING TECHNIQUES

These two areas were assigned to the personnel at the National Tree Seed Laboratory because they have the expertise in this area. Developing inexpensive cone dryers and seed dryers for extracting seed from bumper cone crops is the area where the most bottlenecks occur in the cleaning process.

Workshops specifically targeted at longleaf pine cone conditioning have been conducted and more are planned in the future. Only one workshop per year is being taught due to time restraints on personnel and the limited conditioning season. Drying cones and seed with information from

psychometric equipment and charts are being taught in the workshops. A specific gravity cylinder built out of PVC was designed and constructed by Bob Karrfalt at the National Tree Seed Laboratory. Graduated cylinders are normally used for this procedure except that cylinders large enough to float longleaf pine cones do not have fine enough graduations to calculate specific gravity. The instructions to build the cylinder are being distributed and will be published in *Tree Planters' Notes* for future reference.

Building plans for an inexpensive seed dryer still needs to be developed. Inexpensive drying systems need to be investigated before the next bumper crop. Alternative drying systems could be tobacco barns, heated warehouses with fans, or poly greenhouses.

SHORT-TERM GOAL 4: SEED QUALITY

Steve Oak is continuing to identify insect and pathogens of longleaf pine seed that reduce germination. He is working cooperatively with graduate students at Auburn University. Michelle Cram, pathologist with the Forest Service, is working on longleaf pine seed problems as they relate to nurseries.

SHORT-TERM GOALS 5 AND 6: PROPERTIES OF SEED AND STORAGE

Dr. Barnett has compiled his research on longleaf pine cone and seed conditioning into one publication. It is currently being edited and reviewed. The paper is targeted at the novice longleaf pine grower and seed handler. It will be available as a research bulletin and eventually put on the Internet.

LONG-TERM GOALS

The long-term goals need to be addressed now that progress is ongoing with the short-term goals.

LONG-TERM GOAL 1: CONELET ABORTION

Longleaf pine is notorious for aborting a large proportion of its conelets a couple of months after pollination. If this problem could be solved it would greatly reduce the seed shortage. Dr. Hare was successful in reducing conelet abortion with Cytex (kinetin). In 3 separate annual tests, Cytex increased first-year conelet retention from 33 to 62 percent, 51 to 78 percent, and 53 to 72 percent (with boron).

Conelet abortion could also be a result of insect predation. Dr. McLemore studied 1,000 flowers and only 1 conelet remained after 7 months. *Dioryctria* was identified as the

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Citation for proceedings: Barnett, J.P.; Dumroese, R.K.; Moorhead, D.J., eds. 2002. Proceedings of workshops on growing longleaf pine in containers—1999 and 2001. Gen. Tech. Rep. SRS-56. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 63 p.

primary predator. Conelet abortion may be a combination or interaction of insect predation and cytokinin activity. Before operational recommendations can be made the cause still needs to be discovered.

A study plan needs to be developed to address this problem. To replicate Dr. Hare's work, the Cytex should be applied in a longleaf pine seed orchard that has been sprayed with pesticides. A one percent Cytex solution can be applied operationally with a mist blower. Once the proper procedure is established then other orchards can be added. It would be interesting to try the solution on cone producing trees in the woods. Due to the height of mature trees, an airplane or helicopter may be necessary for the solution to reach the crown.

LONG-TERM GOAL 2: SEED ORCHARDS

It is easier to collect cones in orchards than from trees in the woods because seed orchards are specifically designed and managed for seed collection. In 1981 there were approximately 443 acres of longleaf pine seed orchards. Some are grafted and the others are thinned progeny tests.

The current demand for longleaf pine seedlings exceed 125 million per year. This equates to 208,333 bushels per year or 50,000 pounds of seed annually based on a 50 percent germination rate. Approximately 5,208 acres of seed production areas would be needed to supply the seed assuming there is 5,000 seeds/lb., 40 seeds/cone, 30 cones/tree, and 40 trees/acre. The periodic cone crops precludes the production of 50,000 pounds of seed per year.

The Forest Service needs to keep their longleaf pine orchards and seed production areas open for public use. If the Forest Service cannot pay to manage orchards and seed production areas, maybe a cooperative can be formed that can take over the management. Since the demand is so strong, the Forest Service should identify more stands that can be converted to seed production for the public's use. Since one third of the longleaf pine resource is on Forest Service land, it is imperative that the Forest Service be involved to meet the future demand for seed.

There is a need to resurrect the research on longleaf pine genetics and the development of seed orchards to augment the seed production areas. Ninety seven percent of the longleaf pine acreage is gone and it is not known how much more can be removed before genetic diversity is at risk. Clone banks are owned by the Forest Service, the Western Gulf and University of Florida forest genetics research cooperatives. What is going to happen to these clone banks in the future? Will landowners, who want to establish longleaf pine seed orchards, have access to this genetic material?

When the seed is in short supply, the available seed will be planted anywhere without regard to seed source. The landowner may receive a seed source not adapted to his or her area, and the result will be poor tree growth and/or survival. Long term studies have shown that the species is not as genetically diverse as loblolly, so seed sources can move great distances east or west without an adverse effect on growth or survival. Even so, the sources in southern

Florida do not perform well farther north; north Alabama sources do not perform well planted south; and Louisiana sources are more susceptible to needle blight fungus. It is questionable how well North Carolina and South Carolina sources will grow further south.

LONG-TERM GOAL 3: FERTILIZATION

Fertilization of longleaf pine trees to stimulate flowering works at some locations and not others. It has even been shown to be detrimental to the production of male flowers in one location. Fruitfulness may be more a function of temperature than nutrient fertility. Locating seed orchards and seed production areas in the southern part of the species' range where there is less chance of winter freezes may be the solution. Pollen may be more a limiting factor than fertilization since the orchards and seed production areas may not be located near other longleaf pine stands for supplemental pollination. There is still much that is not known about what stimulates longleaf pine to produce flowers and pollen.

LONG-TERM GOAL 4: RESEARCH

As the seed supply dwindles, the cone surveys conducted by Dr. Boyer become even more important. Will someone carry on the cone surveys? Past Forest Service research on longleaf pine reproduction needs to be resurrected and additional research needs to be conducted to fill in the gaps in our knowledge.

The biggest question is how to get the funding and who will conduct the research. The Longleaf Alliance only has funds to act as a clearinghouse for information. Funding sources need to be aggressively sought.

LONG-TERM GOAL 5: SEED CERTIFICATION

When there is a critical seed shortage, growers are going to buy the seed wherever they can and not worry about the seed source. The landowners have to plant what is available and probably never know the seed's origin. It is advised not to move seed sources more than one seed zone north or south. I'm not sure if seed certification is necessary with longleaf pine since there is more genetic diversity within populations than among populations. Seed and seedling certification is done by the state crop improvement associations. The certification fees are fairly nominal. A system to certify growers does not currently exist.

LONG-TERM GOAL 6: VEGETATIVE PROPAGATION

The area of micropropagation and vegetative propagation could greatly take the pressure off the need for large quantities of seed. Artificial regeneration can produce a large amount of seedlings with a smaller amount of seed than natural regeneration. Will longleaf pine cuttings produce roots and is the procedure the same as rooting the other southern pines? Rooted cutting would not have a grass stage so different site preparation and planting techniques will be needed.

LONG-TERM GOAL 7: INSECT PREDATION

The extent of insect predation on longleaf pine cones is not as well known as with loblolly and slash pine. Insect monitoring is usually not done in seed production areas. We

need to know how much of longleaf's cone crop loss is due to insect predation. Cone insects may have a deleterious effect at one location but not at another location. Information from seed orchards could be collected on cone insects with monitoring system devised by Dr. Carl Fatzinger. It has been shown that pesticide applications can save 85 percent of the cone crop in loblolly and slash seed orchards.

CONCLUSION

Good progress is being made on addressing the seed supply shortage. Much work has been accomplished on the short term goals since the September 22, 1999 meeting in Jesup, GA. Annual seed conditioning workshops are being held and information is being compiled into resource bulletins. A symposium addressing the seed supply shortage would be a good way to compile information into one resource for the public.

A letter addressing the research needed to solve the seed shortage still needs to be written to the USFS technical transfer liaison to Forest Service research.

Even with these efforts there is still a critical seed shortage. It will take a regional effort from organizations to really solve the problem. To be truly successful the Forest Service national forest system needs to allow seed dealers more access to longleaf pine of cone producing age. Stands could be converted to seed production areas with seed dealers managing the stands. The southern research stations can help the public by finding solutions to the problems associated with longleaf pine cone production.

IDEAS TO SOLVE THE LONGLEAF PINE SEED SHORTAGE PROBLEM

Short-term Goals:

1. Locate and establish more seed production areas (SPAs) needed by state
 - a. identify existing SPAs by state and ownership
 - b. develop maintenance regimes on how best to manage SPAs
 - c. how to stimulate seed production
 - d. estimating cone crop and maturity
 - e. conelet abortion—how to reduce
 - f. determine the amount of acreage needed in the species range and by state or seed zones
 - g. determine how much seed is needed to meet the demand
 - h. role of Forest Service land in developing SPAs
2. Not enough cone dryers for bumper crops.
 - a. identify inexpensive ways to dry large cone crops
 - b. build models
 - c. test alternative ways to dry cones and monitor success
 - d. construct inexpensive structures to store cones before drying

- e. teach how to use psychometric equipment and charts.
 - f. distribute a list of suppliers for products
3. Seed dryers
 - a. distribute building plans for constructing a seed dryer
 - b. test alternative ways to dry seed so cone dryer is freed up for cone collection
 - c. hold workshops to demonstrate cone processing techniques
4. Seed quality
 - a. insects and pathogens
 - b. seed damage
5. Cone crops
 - a. what stimulates cone production?
 - b. how to stimulate cone production
 - c. insect control
 - d. collection procedures
 - e. how to predict when cones are ready to collect
6. Storage
 - a. storage of cones before extraction—already known
 - b. storage of seed—moisture content—already known

Long-term Goals:

1. Conelet abortion
 - a. expand Dr. Hare's work on applying cytokinins on conelets
 - b. need to try his recommendations over different soil types and climates to see if it works for all locations
2. Seed orchards
 - a. how many acres do we need to meet demand?
 - b. are research co-ops going to get involved in clonal selection?
3. Fertilization
 - a. does fertilizer work with species?
 - b. does fertilizer only work on certain soil types?
4. Research
 - a. what research needs to be done and who will do it?
 - b. who has money to fund research?
 - c. applied versus basic
5. Seed certification
 - a. identify collections by seed zone
 - b. label plants by seed zone
6. Vegetative propagation
 - a. micropropagation
 - b. rooted cuttings
 - c. needle fascicles